

**UNITED STATES DISTRICT COURT
DISTRICT OF MASSACHUSETTS**

SINGULAR COMPUTING LLC,

Plaintiff,

v.

GOOGLE LLC,

Defendant.

Civil Action No. 1:19-cv-12551-FDS

Hon. F. Dennis Saylor IV

REDACTED VERSION

**PLAINTIFF'S REPLY IN SUPPORT OF ITS MOTION TO
EXCLUDE CERTAIN TESTIMONY OF LAURA B. STAMM AND
DR. MARTIN WALKER REGARDING REASONABLE ROYALTY**

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I. Google Did Not Disclose bf20 as a Non-Infringing Alternative Until It Served Its Rebuttal Expert Reports.

A. Google’s Interrogatory Answer Does Not Disclose bf20 as a Non-Infringing Alternative.

Interrogatory No. 16 called for Google to “[i]dentify any products or processes that You contend are acceptable non-infringing alternatives to the Accused Product” and for Google to include in its answer detail concerning the bases for its contention that each alleged alternative does not infringe, including “[w]hich claim elements [Google] contend[s] are absent from each alleged non-infringing alternative.” Ex. E at Interrogatory No. 16. Google relies on the following language in its supplemental response to Interrogatory No. 16 to assert that it disclosed bf20 as a non-infringing alternative during fact discovery:

Versions of the TPUv2 and TPUv3 that have been modified to avoid the allegedly infringing functionality by, for example representing numbers using formats other than bfloat16, including . . . formats that represent numbers using **an exponent of 8 bits, a sign bit, and a fraction [ie., mantissa] of up to 15 bits**, which the TPUv2 and TPUv3 MXU multiplier could have supported with no modification or limited modification; or any other format.

Ex. E at Supplemental Response No. 16 (emphasis added).¹

Neither the emphasized language nor any other language in Google’s response to Interrogatory No. 16 identifies bf20 (namely, exponent of 8 bits, a sign bit, and 11 mantissa bits) or any other specific non-infringing number format. Google’s description of the number formats that could have been used – an exponent of 8 bits, a sign bit, and a fraction [mantissa] of *up to* 15 bits – includes fifteen different combinations of 1 to 15 fraction bits. Google did not bother to identify any specific number format it planned to rely on at trial and failed to make any attempt to explain its contention that any one of the fifteen different number formats does not infringe the

¹ References to Exhibits A-M are to those attached to the Declaration of Kevin Gannon (ECF No. 466-2) filed in support of Singular’s Opening Brief. Exhibits N, O, P, Q, R, and S are attached to the Declaration of Daniel McGonagle filed herewith.

Patents-In-Suit. This left Singular to guess whether Google intended to rely on all 15 formats, or fewer, and if fewer, which ones.

Moreover, when deposed, Google's Rule 30(b)(6) fact witness who testified about alternatives to the accused devices did not mention a "bf20" non-infringing alternative, Opening Br. at 4-5, nor could he, as Google's technical expert, Dr. Martin Walker, had yet to choose it as Google's non-infringing alternative.

At his deposition after the close of fact discovery, Dr. Walker explained that he [REDACTED] [REDACTED] the report of Singular's expert, Dr. Khatri. Ex. N, Walker Tr. at 196, 202:8-203:7. He explained further that [REDACTED]

[REDACTED] Dr. Walker explains in his Report that he analyzed alternative number formats to identify a non-infringing alternative. Dr. Walker started by adding one mantissa bit to bfloat16, which he calls bfloat17 (8 mantissa bits), and he concluded that bfloat17 infringes because, like bfloat16, its results differ by at least 0.05% from the result of an exact mathematical equation. Ex. O, Walker Rpt. at ¶¶ 282 and 284. He reached the same conclusion on bfloat18 (9 mantissa bits) and bfloat19 (10 mantissa bits). *Id.* That is how Dr. Walker settled on [REDACTED]

[REDACTED] Ex. N, Walker Tr. at 202:19-203:7 [REDACTED]

[REDACTED] Google did not share any of this analysis with Singular until serving Dr. Walker's expert report on March 3, 2023.

If the Court were to accept Google's argument that its response to Interrogatory No. 16 discloses bf20 as a non-infringing alternative, it would undermine the purpose of contention interrogatories, which is to timely learn the bases for your opponent's defenses and its theory of the case. *See Exxon Research and Engineering Co. v. U.S.*, 44 Fed. Cl. 597, 601 (Fed. Cl. 1999). It is Google's obligation to disclose its contentions; it is not Singular's obligation to somehow divine from a vague range of number formats which formats do or do not infringe and, to the extent they do not infringe, which format Google will rely on at trial. The Court should not tolerate this type of gamesmanship. All evidence concerning bf20, including testimony from Dr. Walker and Ms. Stamm, should be excluded from trial. *See e.g., Pelican Int., Inc. v. Hobi Cat Co.*, C.A. No. 20-cv-02390, 2023 WL 2127995 at *12-14 (S.D. Cal. Feb. 10, 2023) (excluding evidence of non-infringing alternatives that defendant failed to identify in response to contention interrogatories and disclosed for the first time in rebuttal expert reports); *SynQor, Inc. v. Artesyn Techs., Inc.*, No. 2:07-cv-497, 2011 WL 3625036, at *10-11 (E.D. Tex. Aug. 17, 2011) (affirming decision to preclude evidence of non-infringing alternatives where defendant failed to disclose them during fact discovery and failed to comply with its obligation to timely supplement interrogatory answers) *aff'd*, 709 F.3d 1365 (Fed. Cir. 2013).

B. Google Cannot Rely on Its Document Production To Establish Disclosure of bf20 as a Non-Infringing Alternative.

In the absence of proper disclosure in response to Interrogatory No. 16, Google resorts to arguing that its production of certain documents adequately disclosed bf20 as a non-infringing alternative. Opp. at 8 (arguing that it disclosed bf20 by "produc[ing] documents that referenced the availability and existence of bfloat20 and similar number formats [and by] produc[ing] documents showing how [REDACTED]").

██████████). It makes this argument even though it does not refer to documents in its interrogatory response or otherwise refer to Fed. R. Civ. P. 33(d),

As Google knows, Rule 33(d) allows a party to produce documents in lieu of answering an interrogatory only if, among other things, the responding party “specif[ies] the records that must be reviewed, in sufficient detail to enable the interrogating party to locate and identify them as readily as the responding party could”). While Google relied on Rule 33(d) in response to other interrogatories (*see e.g.* Kamber Decl. at Ex. E, Response No. 18), it does not identify a single document in support of the statement that the fifteen alternative number formats could have been used to avoid infringement. *See* Ex. E at Response No. 16. As such, Google cannot rely on its document production to avoid its failure to disclose bf20 in response to Interrogatory No. 16. *See e.g., Pelican Int.*, 2023 WL 2127995 at *12-14 (excluding evidence of non-infringing alternatives where, although documents produced in discovery referenced the alternatives, defendant failed to identify the alleged alternatives in response to contention interrogatories). But even if it could, its argument would still fail because neither of the documents on which Google relies actually discloses bf20 as a non-infringing alternative.

Google asserts that one of its own patents, U.S. Patent No. 10,621,269 (the “’269 Patent”), disclosed bf20 as a non-infringing alternative, but that patent does not involve the relevant use, namely, using bf20 *as an input to an operation*. Google cites an excerpt from the ‘269 patent that discloses (i) the prior art full precision 32 bit format (fp32 or “IEEE single precision format”), (ii) the 16-bit format (bf16) (incidentally, this is the format that the accused TPUs use as an input into a multiplication operation) and (iii) a 20-bit format, which it describes as “[a]n expanded bfloat format” (bf20). Opp. at 8. The next sentence in the patent, which Google does not quote, explains that it is only the “product” of the inputs (i.e. *the output of the multiplication operation*) that is

stored in expanded bfloat format (bf20), and not the inputs to the multiplication operation (which are stored in bf16 format, as in the accused TPUs). Kamber Decl. at Ex. K, ‘269 Patent at 15:22-29. The ‘269 patent’s use of bf20 is thus completely different than the use Google relies on as a non-infringing alternative. Dr. Walker contends that bf20 is a non-infringing alternative to Google’s use of [REDACTED] *See e.g.*, Ex. O, Walker Rpt. at ¶¶ 264, 268. The ‘269 Patent does not disclose the use of bf20 as an input into any operation, nor does it otherwise identify an alternative to the use of [REDACTED]

The other document on which Google relies does not mention bf20. That 47-page document, entitled [REDACTED] reflects Google’s analysis of number formats [REDACTED] Kamber Decl., Ex. H at GOOG-SING-00004768 ([REDACTED] [REDACTED] [REDACTED]); Ex. O, Walker Rpt. at ¶ 285 (describing bf20 as having an 11 bit mantissa). Thus, even if Google could rely on this document in an attempt to cure its deficient interrogatory response, its argument would still fail.

II. Singular Did Not Have the Opportunity to Question Google Witnesses About bf20.

Google asserts that Singular had the opportunity to question witnesses about bf20 because Google provided its supplemental answer to Interrogatory No. 16 prior to the depositions of Google witnesses with knowledge of non-infringing alternatives (Drs. Jouppi and Patil). Opp. at 9. Any such questioning would have been futile until Google’s technical expert, Dr. Walker, actually chose bf20 as a non-infringing alternative, more than a year after fact discovery closed, let alone before Dr. Walker’s [REDACTED] was disclosed to Singular. This futility was

proven during the deposition of Google's Rule 30(b)(6) witness who testified about alternatives and understandably did not identify the yet-to-be-considered bf20 format. Opening Br. at 4-5.

III. The Prejudice Caused By Google's Failure to Disclose bf20 Cannot Be Cured.

With no sense of irony, Google criticizes Singular's experts for not responding to Google's disclosure of bf20. Opp. at 9-10. As set forth in its Motion and above, Google did not disclose bf20 until it served the rebuttal expert reports of Dr. Walker, Ms. Stamm and Google's data center expert, K.C. Mares, weeks after Singular's experts served their reports and well over a year after fact discovery closed. Google nonetheless suggests that Singular's experts should have either analyzed bf20 based on its response to Interrogatory No. 16 (which does not disclose it) or at the very least, should have reviewed Google's experts' opinions regarding bf20 and been prepared to respond during their depositions. *Id.* Ignoring the fact that Singular never had the opportunity to conduct any fact discovery concerning bf20 as an alleged non-infringing alternative, Google also suggests that Singular was not prejudiced by the late disclosure because "Singular had the ability to ask both Ms. Stamm and Dr. Walker about the bfloat20 alternative and did so during their depositions." *Id.* at 10.

Contrary to Google's assertions, the prejudice resulting from Google's failure to disclose bf20 is clear, and in similar cases courts have not hesitated to exclude evidence of non-infringing alternatives. For example, in *Pelican Int.*, the court precluded an expert from testifying about alleged non-infringing design-arounds pursuant to Rule 37. 2023 WL 2127995 at *12-14. In that case, after disclosing the allegedly non-infringing design-arounds after fact discovery had closed and after expert reports were completed, the defendant offered to attempt to cure any prejudice by allowing the plaintiff to re-open the deposition of its chief executive officer. *Id.* The court concluded that the offered deposition was insufficient to cure the prejudice suffered by the plaintiff

because expert reports had already been exchanged and, as a result, plaintiff's damages and technical experts were not able to consider the design-arounds as non-infringing alternatives in their opening or rebuttal reports. *Id.*; see also *SynQor*, 2011 WL 3625036 at *10-11 (excluding expert testimony regarding non-infringing alternative where defendant's failure to disclose non-infringing alternative in interrogatory response deprived defendant of necessary discovery to respond to defendants' assertion that non-infringing alternative existed).

The prejudice suffered by Singular in this case is identical to that suffered by the plaintiffs in *Pelican* and *SynQor*. Google's failure to properly disclose its contention that bf20 is a non-infringing alternative to bf16 deprived Singular of conducting appropriate fact discovery, including depositions of Google fact witnesses and deprived Singular's technical, damages and data center experts of the opportunity to address bf20 in their expert reports. Singular's ability to examine Google's experts was also handicapped by the absence of relevant fact discovery.

At this stage of the case, it is far too late to attempt to cure this prejudice and all evidence concerning bf20 should be excluded. If, however, the Court somehow finds that Google should be permitted to introduce evidence of bf20 at trial, Singular should be allowed to re-open the fact depositions of Google engineers, Dr. Norm Jouppi, who Ms. Stamm and Dr. Walker rely on extensively, and Dr. Patil, who served as one of Google's Rule 30(b)(6) witnesses. It will also be necessary for Singular to re-open the depositions of Google's three experts, Dr. Walker, Ms. Stamm and K.C. Mares, and for Singular's three experts, Dr. Khatri, Mr. Green and Mr. Isaak to supplement their expert reports.

IV. Federal Circuit Precedent Establishes that bf20 Was Not Available At The Time of the Hypothetical Negotiation.

Google relies on the Federal Circuit's decision in *Grain Processing Corp. v. Am. Maize-Prods. Co.*, 185 F.3d 1341 (Fed. Cir. 1999) to argue that bf20 was available at the time of the

hypothetical negotiation. Opp. at 14. In *Grain Processing*, the court held that, in certain circumstances, a technology can be considered an “available” non-infringing alternative for purposes of determining lost profits even if it was not on the market during the infringement period (i.e. the “accounting period”). *Id.* at 1351-52. While not establishing a “rigid test” for determining availability, the court explained that, where the alleged alternative was not on the market, the accused infringer has the burden to establish that, at the time of infringement, it had the “necessary equipment, know-how, and experience” to implement the non-infringing alternative. *Id.* at 1354-55.² A finding that development of the non-infringing alternative requires the accused infringer to design or invent around the patent to avoid infringement weighs against a finding of availability. *Id.* at 1354; *see also Micro Chemical, Inc. v. Lextron, Inc.*, 318 F.3d 1119 (Fed. Cir. 2003) (“[The *Grain Processing* court] noted that the finding that an infringer had to design or invent around the patented technology to develop an alleged substitute weighs against availability.”).

A few years later, in *Micro Chemical*, the Federal Circuit further explained that to establish a technology not on the market is nonetheless an available non-infringing alternative, the accused infringer must establish that its “equipment, know-how, and experience” would have allowed it to “readily” use the non-infringing alternative. *Id.* at 1122-23; *Siemens Med. Sols. USA, Inc. v. Saint-Gobain Ceramics & Plastics, Inc.*, 637 F.3d 1269, 1288 (Fed. Cir. 2011) (citing *Micro Chemical* and stating: “[a] substitute need not be on sale at the time of infringement, but if the substitutes

² In lost profits cases like *Grain Processing*, the plaintiff first bears the burden to establish the absence of non-infringing alternatives on the market. *Grain Processing*, 185 F.3d at 1351-52. If there is no alternative on the market, the court is free to infer that an alleged alternative not on the market is not available. The defendant can then rebut that inference by showing that it had the “necessary equipment, know-how, and experience” to readily implement the non-infringing alternative. *Id.* The Federal Circuit has not addressed whether *Grain Processing* applies in a case involving reasonable royalty damages. *See MicroVention, Inc. v. Balt USA, LLC*, C.A. No.: 19-cv-01335, 2022 WL 18284997 at *2 (C.D. Cal. Dec. 12, 2022) (“It is not entirely clear whether a non-infringing alternative not on the market at the beginning of infringement can be considered ‘available’ in a reasonable royalty case.”). Even if it does, based on the record evidence, Google cannot satisfy its burden to establish availability of bf20 at the time of the hypothetical negotiation.

cannot be commercialized ‘readily,’ then it is not available for purposes of a lost profits determination.”).

In *Grain Processing*, the court affirmed the trial court’s finding of availability where the accused infringer was able to show that it need not design around the patented technology and that, using its equipment, know-how, and experience, it was able to implement the non-infringing alternative in just two weeks, which the court described as “practically instantaneous.” *Grain Processing*, 185 F.3d at 1346. The court reached the opposite conclusion in *Micro Chemical*. In that case, the evidence established that the accused infringer expended 984 hours to design the non-infringing alternative, another 330 to test it and that one of its engineers worked on the design full-time for several months. *Micro Chemical*, 318 F.3d at 1123. It then took another two months to convert all of the infringing machines to non-infringing machines. *Id.* Based on those facts, the Federal Circuit concluded that the accused infringer did not have “the necessary equipment, know-how, and experience” to make the non-infringing alternative at the time of infringement. *Id.*

Google cannot satisfy its burden to prove availability under *Grain Processing* and *Micro Chemical*. To date, Google has not presented any evidence that, at the time of the hypothetical negotiation in March 2017, it could have “readily” designed, developed and deployed TPU systems with bf20 chips instead of the bf16 chips it had already designed and was ready to deploy. Instead, Google relies on conclusory statements by its own experts, which are based on undisclosed discussions with Google employees. For example, in her report, Ms. Stamm states: [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] Ex. P, Stamm Rpt. at ¶ 77. The only citation for that statement is a [REDACTED] *Id.* at

34 n.167. In its Opposition, Google doubles down, citing Ms. Stamm’s deposition testimony for the proposition that “the facts demonstrate that Google had the ‘materials needed’ to produce the bfloat20 alternative, it had the ‘know-how’ to do so, and that doing so was ‘not prohibitively expensive.’” Opp. at 14-15. In support of that statement, Google cites the following excerpt of Ms. Stamm’s testimony that includes more conclusory assertions, without any factual support of any kind:

Q. [REDACTED]
[REDACTED]
[REDACTED]

A. [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

Ex. Q, Stamm Tr. at 30:11-22.³ These conclusory statements, untethered to any factual evidence in the record, are not sufficient to satisfy Google’s burden to establish availability at the time of the hypothetical negotiation. *Grain Processing*, 185 F.3d at 1353 (“[m]ere speculation or conclusory assertions [do] not suffice to overcome the inference [that an alleged alternative not on the market is not an available substitute].”).

The only evidence concerning the time it would have taken Google to design, develop and deploy TPU v2 and v3 chips using bf20 instead of bf16 is once again from Google’s experts, Dr. Walker and Ms. Stamm. Both state in that it would [REDACTED]

[REDACTED] Ex. N, Walker Tr. at p. 208:23-209:7; Ex. Q, Stamm Tr. at p. 36:22-37:10 and p.41:2-12. There is no dispute that it took

³ Google cites an additional excerpt from Ms. Stamm’s testimony, but that testimony relates to the legal standard for determining availability, not to Google’s ability to design and develop chips using bf20. *See* Opp. at 14 n.14 (citing Kamber Decl., Ex. O (Stamm Tr.) at 27:7-20).

Google approximately [REDACTED] Ex. R, Jouppi Tr. at p. 157:17-19 (stating that [REDACTED]); Ex. P, Stamm Rpt. at ¶ 122 (agreeing that the hypothetical negotiation would have occurred in [REDACTED] [REDACTED] Thus, the only evidence probative of how “readily” Google could have deployed TPUs indicates that it would take [REDACTED] the TPUv2 using bf20.

As of March 2017, Google had spent \$[REDACTED] to design and develop TPUv2 and was ready to deploy that chip. Ex. S Green Report at p. 102. To avoid infringement at that time, Google would have had to scrap the TPUv2 chips that were ready for deployment, abandon its work to design and develop the TPUv3 chips, which was underway, and begin designing and developing a TPU using bf20, which according to the testimony of both Dr. Walker and Ms. Stamm would not have been completed [REDACTED]. Under the Federal Circuit’s reasoning in *Micro Chemical*, a [REDACTED] is far too long for an alternative to be considered “readily available.” *Micro Chemical*, 318 F.3d at 1123 (reversing summary judgment finding that alternative that required months of design and testing was available); *see also SynQor*, 2011 WL 3625036, at *11 (stating that exclusion of non-infringing alternatives on procedural grounds was harmless because the alternative was “more than eight months away from being ready.”).

To avoid these critical facts, instead of focusing on the facts as they existed at the time of the hypothetical negotiation in March 2017, Google’s experts attempt to travel back in time from March 2017 and opine that, had Google started designing the TPUv2 using bf20 at the same time as it started designing the TPUv2 using bf16 (i.e., i [REDACTED] [REDACTED]

████████████████████. See e.g., Ex. N, Walker Tr. at p. 209:12-20; Ex. Q, Stamm Tr. at p. 36:22-37:10 and p. 41:2-12. But the law requires the parties to consider the hypothetical negotiation based on the facts as they existed at that time of first infringement, not based on what the defendant could have done if it took a different course of action years before infringement began. *Uniloc USA, Inc. v. Microsoft Corp.*, 632 F.3d 1292, 1318 (Fed. Cir. 2011) (expert opinions must be tied to the facts and “the hypothetical negotiations that would have taken place in light of those facts and circumstances at the relevant time.”). It is undisputed that Google never used bf20 prior to the hypothetical negotiation and has not since used bf20 in any TPU. Opening Br. at 6-8. On the record evidence, Google cannot satisfy its burden to show that it could “readily” deploy a bf20 chip in March 2017 and the Court should preclude it from offering any documentary or testimonial evidence concerning bf20.

V. Singular’s Objection to bf20 Evidence Goes to Its Admissibility, Not Weight.

Google suggests that there is a blanket rule that challenges to evidence concerning the availability of non-infringing alternatives goes to the weight of the evidence, not to its admissibility, Opp. at 16, going so far as to suggest that the jury should decide whether a two-year delay in deploying a chip using bf20 renders the chip unavailable. Opp. at 15 n.15. These assertions are inconsistent with the Federal Circuit’s decisions in *Grain Processing* and *Micro Chemical*.⁴ The Court should exercise its discretion to exclude evidence concerning bf20.

VI. CONCLUSION

For the foregoing reasons, Singular’s Motion should be allowed.

⁴ The cases on which Google relies (see Opp. at 16-17) do not support its argument. In each of those cases, the court concluded that under the specific facts and evidence at issue, the specific objections in those cases went to the weight, not admissibility. That is not the case here.

Dated: June 2, 2023

Respectfully submitted,

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CERTIFICATE OF SERVICE

I certify that on June 2, 2023, all counsel of record who have consented to electronic service are being served with a copy of this document via email.

/s/ Adam R. Doherty